Perceived Versus Actual Risk

Grades

Secondary

Subjects

Science

Type of Lesson Plan

Activity

Suggested Duration

30 – 45 minutes

Materials

- *Understanding Risk* handout
- *Perceived Risk / Actual Risk* handout
- *Actual Risk* overhead

Objectives

TLW…

- Understand the difference between voluntary versus involuntary risk.
- Recognize factors that account for the difference between perceived and actual risk.

Set

Ask students which of the scenarios listed below puts them at greatest risk to their health and safety.

1. Being forced to live in a house located one mile away from a nuclear power plant.
2. Playing with fireworks.

Playing with fireworks is by far more risky than living next to a nuclear power plant. Each year, there are thousands of reported serious injuries in the United States associated with fireworks. To date, only 3 deaths have been attributed to nuclear power plants in North America despite the potential for increased risk of developing cancer. However, many students will choose living next to the power plant as the riskier of the two scenarios. Why? One of the reasons is that playing with fireworks is a voluntary act. Many students will assume that because a choice is involved in the scenario the risk of the action will be reduced. This is not necessarily so as the following exercise will demonstrate.

Instructional Input

Distribute the *Understanding Risk* handout. Allow the class time to read the document and then discuss. Clarify any questions about the risk factors discussed by soliciting examples from the class.

Hand out the *Perceived Risk/Actual Risk* worksheet. Have the students complete the "Perceived Risk" side of the table only and then stop. Once all students have completed the table, determine which actions the class ranked as being the most risky and the least risky (take a hand tally). Next, display the answer key (*Actual Risk*) on the overhead and allow the class to fill in their papers. Allow the class time to compare their perceptions of risk with the actual risk ranking. Ask them to complete the Accept or Reject column and be prepared to share their reasons. Students should pay special attention to the actual risk of an activity before choosing to accept the risk. For instance, many people ride motorcycles. However, would they still choose to do so if they knew the actual risk they were taking? Accepting the risk means continuing the activity with no change in behavior. Rejecting the risk means a person may have to alter their behavior to avoid the risk.

Evaluation

Have students complete the questions on the back of the *Perceived Risk/Actual Risk* sheet.

Closure

Ask students why they would accept or reject certain risks as listed on their sheets. Listen for factors that affect risk perception listed in the *Understanding Risk* handout. Make sure you point those factors out to the class as they come up.

Have students hand in their papers.

Understanding Risk

Probability – The chance of something happening, usually expressed as a fraction or percent. There is never a 0% chance (will never happen) or 100% chance (guaranteed to happen) when we are talking about risks incurred as a result of an action. This is because there is always some amount of uncertainty.

Uncertainty – A lack of knowledge about factors that may affect the outcome of an action.

Risk – The probability that something bad will happen as the result of an action.

Hazard – A measure of the severity of a harmful effect or event.

Exposure – An individual or group's contact with an environmental contaminant. This contact includes ingestion (eating and drinking), inhalation (breathing), and absorption (skin contact).

Dose – The amount of a contaminant that enters the body.

Toxicity – A measure of the ability of a substance to cause adverse health effects.

The risk of suffering an adverse health effect from exposure to an environmental contaminant depends on the exposure, the toxicity of the contaminant, the dose of the contaminant you are exposed to, and personal characteristics. Risk assessors, health assessors, and toxicologists communicate risks in terms of numbers (quantitatively). Below is a probability table displaying how risk can be communicated quantitatively.

Wording	Fraction	Decimal	Percent	Scientific Notation
One in ten chance	1/10	0.1	10%	1×10^{-1}
One in one hundred chance	1/100	0.01	1%	1×10^{-2}
One in one thousand chance	1/1,000	0.001	0.1%	1×10^{-3}
One in ten thousand chance	1/10,000	0.0001	0.01%	1×10^{-4}
One in one hundred thousand chance	1/100,000	0.00001	0.001%	1×10^{-5}
One in a million chance	1/1,000,000	0.000001	0.0001%	1×10^{-6}

In reality, people often do not view risk quantitatively. Often people associate risk with an action depending upon their perceptions. There are many factors which influence how people perceive risk. The following factors often influence the public's perception of risk:

Involuntary versus Voluntary – Most people would not like to be forced to jump off a bridge. However, others pay for the privilege of jumping off bridges when they go "bungee jumping." The first risk would be *involuntary*, while the second is clearly *voluntary*. If there is a choice in the matter, many people perceive an action as having less risk.

Uncontrollable versus Controllable – When people are not in control of an action (chlorination of drinking water), they tend to think the action carries greater risk. However, when they are in control of an action (using a chemical water softening system in their home) they tend to think the action carries less risk.

Natural versus Industrial – Natural risks (hiking on Mt. St. Helens) tend to be viewed as more acceptable than industrial risks (walking next to an oil refinery).

Unfamiliar versus Familiar – People drive cars every day but are extremely fearful of living anywhere near a nuclear reactor even though car accidents kill thousands annually while nuclear reactor accidents have resulted in only 3 deaths in North America.

Uncertain versus Certain – People view a proven health hazard like tobacco as less risky than other less well known chemicals such as dioxin. Tobacco has proven health effects whereas the health effects of dioxin have yet to be fully understood by scientists.

Catastrophic versus Ordinary – Flying in a jet airplane is much less risky than driving in a car. Yet the perception is that flying is more dangerous because when a jet crashes it is a much more catastrophic event in terms of damage and lives lost in a single event.

Fair versus Unfair – People in lower socioeconomic communities who face health risks more than those in more affluent neighborhoods often feel a sense of outrage against the source of the risk, especially if there is no direct benefit to their community from the risk in question. Risk without benefit is seen as unfair.

Untrustworthy versus Trustworthy – A person generally doesn't think twice about drinking water from their tap. However, how would that person feel about drinking a cup of water taken from an open, common well in the middle of a town in a third world country?

NAME_____Period_____Date_____

Fill in the "Perceived Risk" portion of the table below. Assign a risk value to each action, and then decide whether the action was voluntary or involuntary. Do not fill in the "Actual Risk" and "Accept or Reject" portions of the table until your teacher presents the actual risks.

Perceived Risk			**Actual Risk**			
Action	**Risk rank 1 = most risk 15 = least risk**	**Voluntary Or Involuntary**	**Action**	**Risk rank 1 = most risk 15 = least risk**	**Voluntary Or Involuntary**	**Accept or Reject WHY?**
Being struck by a meteorite			Being struck by a meteorite			
Coal mining			Coal mining			
Chlorinated drinking water			Chlorinated drinking water			
Farming			Farming			
Firefighting			Firefighting			
Struck by lightning			Struck by lightning			
Hunting			Hunting			
Living with a cigarette smoker			Living with a cigarette smoker			
Motorcycling			Motorcycling			
Motor vehicle accidents			Motor vehicle accidents			
Playing high school football			Playing high school football			
Sky diving			Sky diving			
Smoking – all health effects			Smoking – all health effects			
Smoking – cancer only			Smoking – cancer only			
Swimming			Swimming			

Questions Name_____Date_____

Each student should share the action they perceived as having the most and the least risk.

Which activity did the majority of the students perceive as the most risky? Why?

How does the perceived risk of this activity compare with the actual risk?

Which activity did the majority of the students perceive as the least risky? Why?

How does the perceived risk of this activity compare with the actual risk?

Look at the results from the Actual risk portion of the table. In general, which risks are larger, those that are voluntary, or those that are involuntary?

Please discuss what is wrong with the argument in the following scenario from a risk assessment perspective: A concerned parent hops in the car with their child. There is an active thunderstorm outside with many flashes of lightning. As they are driving to school an argument ensues over the child's desire to play football. The parent states, "I do not want you to play football because it is too dangerous. There is too much risk involved and you could get hurt. My primary concern is for your safety. Football is not safe, so I don't want you playing. Besides, wouldn't your games interfere with our hunting trips and our country rides on the motorcycle?" The child replies, "Yeah, I guess it would. OK, if you don't think it's safe, I won't play." The child exits the car, unfurling an umbrella. "Put that away," exclaims the parent. "I don't want you to get hit by lightning!"

KEY

Actual Risk			
Action	**Lifetime risk (# of harmful events per million participants)**	**Voluntary Or Involuntary**	**Rank Order 1 = most risk 15 = least risk**
Motorcycling	**20,000**	**Voluntary**	**1**
Smoking – all health effects	**3,000**	**Voluntary**	**2**
Sky diving	**2,000**	**Voluntary**	**3**
Smoking – cancer only	**1,200**	**Voluntary**	**4**
Firefighting	**800**	**Voluntary**	**5**
Coal mining	**630**	**Voluntary**	**6**
Farming	**360**	**Voluntary**	**7**
Motor vehicle accidents	**240**	**Involuntary**	**8**
Swimming	**32**	**Voluntary**	**9**
Hunting	**30**	**Voluntary**	**10**
Living with a cigarette smoker	**10**	**Involuntary**	**11**
Playing high school football	**10**	**Voluntary**	**12**
Drinking chlorinated drinking water	**8**	**Involuntary**	**13**
Struck by lightning	**0.5**	**Involuntary**	**14**
Being struck by a meteorite	**0.00006**	**Involuntary**	**15**

Questions Name **KEY** Date

Which activity did the majority of the students perceive as the most risky? Why?

Answers will vary.

How does the perceived risk of this activity compare with the actual risk?

Answers will vary.

Which activity did the majority of the students perceive as the least risky? Why?

Answers will vary.

How does the perceived risk of this activity compare with the actual risk?

Answers will vary.

Look at the results from the Actual risk portion of the table. In general, which risks are larger, those that are voluntary, or those that are involuntary?

Voluntary risks are by far more risky

Please discuss what is wrong with the argument in the following scenario from a risk assessment perspective: A concerned parent hops in the car with their child. There is an active thunderstorm outside with many flashes of lightning. As they are driving to school an argument ensues over the child's desire to play football. The parent states, "I do not want you to play football because it is too dangerous. There is too much risk involved and you could get hurt. My primary concern is for your safety. Football is not safe, so I don't want you playing. Besides, wouldn't your games interfere with our hunting trips and our country rides on the motorcycle?" The child replies, "Yeah, I guess it would. OK, if you don't think it's safe, I won't play." The child exits the car, unfurling an umbrella. "Put that away," exclaims the parent. "I don't want you to get hit by lightning!"

Driving is more risky than playing football
Hunting is more risky than playing football
Motorcycle riding is more risky than playing football
The child's chance of being struck by lightning is minuscule compared to the risks incurred by riding in a motor vehicle, riding on a motorcycle, or hunting.